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TECHNICAL MEMORANDUM
MARCH 1997 GROUNDWATER SAMPLING
RESULTS REPORT

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Montgomery Watson File No. 1252042

Prepared For:

ACS RD/RA Executive Committee

Prepared By:

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May 1997



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**AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA**

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ACS RD/RA Executive Committee

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TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1.0 INTRODUCTION	1
1.1 Objectives	2
1.1.1 Upper Aquifer	2
1.1.2 Lower Aquifer	2
1.1.3 Residential Wells	2
1.2 Procedures	2
1.2.1 Water Levels	2
1.2.2 Monitoring Well Sampling	2
1.2.3 Residential Well Sampling	3
1.2.4 Surveying	3
2.0 SITE HYDROGEOLOGY	4
2.1 Water Levels	4
2.2 Groundwater Flow Direction	4
2.2.1 Upper Aquifer	4
2.2.2 Lower Aquifer	4
2.3 Vertical Gradients	5
2.3.1 Vertical Gradients in Wetlands	5
2.3.1.1 Vertical Gradients in the Lower Aquifer	6
2.3.1.2 Vertical Gradients Between the Upper and Lower Aquifers	6
3.0 SECOND QUARTER MONITORING WELL SAMPLING RESULTS	8
3.1 Upper Aquifer	8
3.1.1 VOCs	8
3.1.1.1 North Side	8
3.1.1.2 East Side	8
3.1.1.3 Southeast Area	8
3.1.1.4 Wetland Area to the West	9
3.1.1.5 Southwest Area	9
3.1.2 SVOCs	10
3.1.3 Pesticides and PCBs	10
3.1.4 Inorganic Parameters	10
3.2 Lower Aquifer	11
3.2.1 VOCs	11
3.2.2 SVOCs	12
3.2.3 Pesticides and PCBs	13
3.2.4 Inorganic Parameters	13

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
4.0 SECOND QUARTER RESIDENTIAL WELL SAMPLING RESULTS.....	14
4.1 Sample Identification.....	14
4.2 Sample Location	16
4.3 Sample Results.....	16
4.3.1 VOCs	16
4.3.2 SVOCs, Pesticide, PCBs.....	16
4.3.3 Inorganic Parameters.....	16

LIST OF TABLES

Table 1	Summary of Field Parameter Results
Table 2	Groundwater Elevations - March 1997
Table 3	Vertical Gradients in Wetlands - March 1997
Table 4	Vertical Gradients in Lower Aquifer - March 1997
Table 5	Vertical Gradients Between Upper and Lower Aquifers - March 1997
Table 6	Summary of Detected Organic Compounds in Monitoring Wells
Table 7	Summary of Inorganic Compounds in Monitoring Wells
Table 8	Summary of Detected Organic Compounds in Residential Wells
Table 9	Summary of Detected Inorganic Compounds in Residential Wells

LIST OF FIGURES

Figure 1	Upper Aquifer Potentiometric Surface
Figure 2	Lower Aquifer Potentiometric Surface
Figure 3	VOCs Detected in Upper Aquifer Monitoring Wells
Figure 4	VOCs Detected in Lower Aquifer Monitoring Wells
Figure 5	Residential Well Sampling Locations

LIST OF APPENDICES

One copy of the Appendices has been provided to U.S. EPA, IDEM, and B&VWS. Additional copies of the Appendices are available upon request to Montgomery Watson.

Appendix A	Laboratory Analytical Data - Upper Aquifer - VOCS, SVOC, PCB/Pesticide
Appendix B	Laboratory Analytical Data - Upper Aquifer - Inorganics
Appendix C	Laboratory Analytical Data - Lower Aquifer - VOCS, SVOC, PCB/Pesticide
Appendix D	Laboratory Analytical Data - Lower Aquifer - Inorganics
Appendix E	Laboratory Analytical Data - Residential Wells - VOCs, SVOC, PCB/Pesticide
Appendix F	Laboratory Analytical Data - Residential Wells - Inorganics
Appendix G	Residential Well Sampling Information

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1.0 INTRODUCTION

This Technical Memorandum summarizes the groundwater monitoring activities conducted at the end of March 1997 at the American Chemical Service, Inc. (ACS) NPL Site in Griffith, Indiana. The previous sampling results were reported in the January 1997 Technical Memorandum, "1996 Groundwater Sampling Results Report."

Monitoring well locations and sampling parameters for March 1997 upper aquifer monitoring activities were defined in the Phase II Upper Aquifer Investigation Technical Memorandum, revised March 1997. Well locations and sampling parameters for the March 1997 lower aquifer monitoring activities were defined in the Lower Aquifer Investigation Report, revised March 1997. The second quarter monitoring well sampling event consisted of the following activities:

- New staff gauges were installed and resurveyed at the Site to replace old staff gauges.
- Water levels were measured in upper and lower aquifer wells, piezometers and staff gauges on March 24, 1997.
- Groundwater samples were collected from 24 upper and 23 lower aquifer monitoring wells during the week of March 24-28, 1997 and analyzed for full scan TCL organic and TAL inorganics.
- Groundwater samples were collected from 18 residential wells in the vicinity of the ACS Site during the week of March 31 to April 2, 1997 and analyzed for full scan TCL organic and TAL inorganics.

Hydrogeological data collected during the March sampling is presented in Section 2. Laboratory analytical results for the March 1997 sampling event are presented in Sections 3 and 4 of this Technical Memorandum. All investigation activities were conducted in accordance with U.S. EPA-approved Specific Operating Procedures (SOPs), draft Quality Assurance Project Plan (QAPP) and U.S. EPA comments regarding the QAPP.

1.1 OBJECTIVES

1.1.1 Upper Aquifer

The specific objectives associated with baseline quarterly sampling activities were defined in the October 1996 Phase 2 Upper Aquifer Technical Memorandum (revised March 1997) and included the following:

1. Monitor groundwater quality at the boundaries of the known extent of contamination to determine whether the contaminant plume in the upper aquifer is remaining constant or expanding.
2. Measure water levels in the upper aquifer to determine how remedial actions are affecting groundwater flow patterns at the Site.
3. Monitor groundwater quality in the plume interior to determine how contaminant concentrations change with time and in response to remedial actions.

1.1.2 Lower Aquifer

Specific objectives for sampling in the lower aquifer were established in the September 1996 Lower Aquifer Investigation Report (revised March 1997) and included the following:

1. Monitor groundwater quality in the lower aquifer to determine if upper aquifer contaminants have migrated into the lower aquifer.
2. Measure water levels in the lower aquifer to verify the consistent horizontal gradient to the north and monitor whether remedial actions affect groundwater flow patterns in the lower aquifer at the Site.

1.1.3 Residential Wells

Eighteen residential well samples were collected in March and April 1997 to determine if the water supply to these residences near the Site showed signs of contamination.

1.2 PROCEDURES

1.2.1 Water Levels

To determine the groundwater flow directions in the upper and lower aquifers and vertical gradients both within and between the aquifers, water level measurements were made at upper and lower aquifer wells and piezometers on March 24, 1996.

1.2.2 Monitoring Well Sampling

Prior to sampling, monitoring wells were purged using low-flow methods in accordance with the approved Monitoring Well Sampling SOP for the Upper Aquifer Investigation (revision: March 21, 1997). Field parameters for pH, specific conductivity, temperature,

and turbidity were measured and recorded during well purging activities. A summary of groundwater sampling field parameter data is presented in Table 1.

Selected upper and lower aquifer monitoring wells were sampled between March 25 and 28 1996 and analyzed for full scan TCL volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs) and TAL inorganic parameters. All monitoring well sampling activities were performed in accordance with the approved Monitoring Well Sampling SOP for the Upper Aquifer Investigation (revision: March 21, 1997).

1.2.3 Residential Well Sampling

Residential wells in the vicinity of the ACS Site were sampled during the week of March 31, 1997 to April 2, 1997. Residential well samples were analyzed for full scan TCL VOCs, SVOCs, pesticides and PCBs and TAL inorganic parameters.

1.2.4 Surveying

Staff gauges reinstalled at the Site were surveyed by Area Survey of Orland Park, Illinois. Survey information, including ground surface and casing elevations for the new staff gauges were used to determine the elevations of groundwater measurements from the staff gauges.

2.0 SITE HYDROGEOLOGY

2.1 WATER LEVELS

Water levels were measured at existing upper and lower aquifer monitoring wells, piezometers, and staff gauges on March 24, 1997. The recorded water levels and calculated elevations are presented in Table 2.

On March 24, 1997, depth to water in the upper aquifer monitoring wells ranged between 1.53 feet below top of casing (toc) in MW-3S to 20.50 feet below toc in MW6 (Table 2). The groundwater elevation in the upper aquifer ranged from 637.05 feet above mean sea level (amsl) at MW5 in the southeast corner of the ACS facility to 627.23 feet amsl, at MW42 located in the southeast portion of the Site.

Depth to water measurements made at staff gauges ranged from 0.64 feet at SG-8R to 2.96 feet at SG-12 (Table 2). The surface water elevations calculated from these measurements were between 630.71 and 635.80 feet amsl.

2.2 GROUNDWATER FLOW DIRECTION

2.2.1 Upper Aquifer

The water table contour map for the upper aquifer, as determined from water levels measured on March 24, 1997, is shown on Figure 1. The direction of shallow groundwater flow in the upper aquifer is generally to the west in the area west of Colfax Avenue, and southeast in the area southeast of the intersection of Colfax Avenue and Reder Road. The westward shallow groundwater flow at the ACS plant is directed towards the dewatering activities at the Griffith landfill. Southeast of the intersection of Colfax Avenue and Reder Road, the direction of groundwater flow in the upper aquifer follows the slope of the land surface to the southeast (Figure 1).

In November 1996, a minor groundwater flow divide appeared to exist in the northeast portion of the Site near Colfax Avenue between MW11 and SG10, and between P9 and P58. This apparent trend was not confirmed by the March 1997 water level data. Based on the March 1997 data, groundwater flow is directed west/northwest in the northeast corner of the Site. Other than this apparent groundwater flow divide, the direction of horizontal groundwater flow in the upper aquifer measured in March 1997 is consistent with upper aquifer data presented in the June 1991 RI and water level data collected on October 30, 1995, and on June 5, August 27, and November 4, 1996.

2.2.2 Lower Aquifer

The potentiometric surface in the lower aquifer as measured on March 24, 1997 is presented in Figure 2. The direction of horizontal groundwater flow in the lower aquifer is essentially northward. This information is based on water levels measured in lower aquifer

wells installed at the top of the aquifer. The northward direction of groundwater flow in the lower aquifer is consistent with lower aquifer data presented in the 1996 Groundwater Sampling Results Report.

The horizontal hydraulic gradient in the lower aquifer in March 1997 was determined to be 0.00040. The gradient was determined by dividing the difference in head between MW22, located in the southern portion of the Site, and MW10, located at the northern Site boundary, (1.13 feet on March 24, 1997) by the lateral distance between the two wells (2,850 feet). The average hydraulic gradient (0.00040) was generally consistent with lower aquifer gradients previously calculated for the Site:

Report of Hydraulic Gradient in Lower Aquifer	Hydraulic Gradient
• June 1991 RI	0.0006
• October 30, 1995 Technical Memorandum	0.00041
• September 1996 Lower Aquifer Investigation Technical Memorandum	0.00047
• Groundwater Monitoring Results Report (August 27, 1996)	0.00047
• Groundwater Monitoring Results Report (November 4, 1996)	0.00049

2.3 VERTICAL GRADIENTS

Vertical gradients were determined across three aquifer horizons (vertical gradients in the upper aquifer in the wetland area; vertical gradients in the lower aquifer; vertical gradients between the upper and lower aquifers). The vertical gradients were calculated using the groundwater elevation data collected on March 24, 1997.

2.3.1 Vertical Gradients in Wetlands

A summary of vertical hydraulic gradients measured in nested piezometers in the wetland area is presented on Table 3. Vertical gradients were calculated by dividing the difference in head between nested piezometers by the distance between the screen midpoints for the piezometers. Vertical gradients in the wetland area were generally very low, showing little difference in hydraulic head between the upper and lower portions of the upper aquifer. Vertical gradients were upward at P64/P65 (0.016), P68/P69 (0.010) and P70/P71 (0.030) and slightly downward at P66/P67 (-0.003).

There is no consistent pattern between vertical gradients measured in wetland area piezometers between various measurement periods:

Piezometer Nest	August 1996	November 1996	March 1997
P64/P65	0.009	0.000	0.016
P66/P67	0.005	0.005	-0.003
P68/P69	0.000	0.000	0.010
P70/P71	-0.02	0.006	0.030

The vertical gradients measured in the wetland area are consistent with a typical wetland area where shallow groundwater is in close contact with surface water. Water levels fluctuate throughout the year as shallow groundwater periodically recharges and discharges from the wetland area. The observations are consistent with Montgomery Watson's prediction in the Response to Comment 15, in the July 15, 1996 letter, responding to U.S. EPA's June 28, 1996 Approval of the Revised Upper Aquifer Investigations Technical Memorandum with modifications.

2.3.1.1 Vertical Gradients in the Lower Aquifer. Vertical gradients measured between nested wells screened within the lower aquifer during the March 1997 water level monitoring event are presented in Table 4. Vertical gradients were calculated by dividing the difference in head between nested wells by the distance between the bottom of the upper screen and the top of the lower screen at each well location. Vertical gradients which were indistinguishable from zero are bolded in the table. This determination was made by dividing the margin of potential error in the water level measurement (0.01) by the vertical separation between the nested well screens. Those vertical gradients which exceed this lowest measurable gradient are considered indistinguishable from zero.

The largest differences in head between nested wells was observed at the MW8 well nest (Table 4). An upward vertical gradient of 0.011 was noted between the upper and middle zones at MW8 and MW31 (although the vertical gradient was upward at MW51 and MW10, the vertical separation between the two wells was essentially zero because the well screens overlap in the aquifer). The largest downward vertical gradient was also observed at the MW8/MW31/MW32 well cluster, where a downward gradient of -0.011 was observed between MW31 and MW32. It is noteworthy that the overall vertical gradient between the top to the bottom of the lower aquifer at this location was 0.000.

Other lower aquifer well nests exhibited vertical gradients less than 0.001 feet (Table 4). In particular, many well nests did not exhibit vertical gradients which were indistinguishable from zero. Eight of the calculated gradients have negative values, whereas seven gradients have positive values. Two calculated gradients were zero. This variability indicates that there is not an overall trend to the vertical gradient data in the lower aquifer.

2.3.1.2 Vertical Gradients Between the Upper and Lower Aquifers. Vertical gradients measured between wells screened in the upper aquifer and lower aquifer are presented in Table 5. Vertical gradients were calculated by dividing the difference in head between the upper and lower aquifer wells by the thickness of the clay confining layer between the two wells.

Strong downward vertical gradients were calculated at each of the nested locations as presented on Table 5. Downward vertical gradients ranged from -0.37 (measured between MW17 and MW28) to -1.0 (measured between P28 and MW8). The greatest difference in groundwater elevations measured at a nested well pair was 11.62 feet between P8 and MW7. These vertical gradients are nearly the same as those calculated in 1996. The consistent calculation of strong downward vertical gradients suggests that the low permeability of the upper confining clay layer provides a substantial barrier to vertical groundwater flow between the two aquifers.

3.0 SECOND QUARTER MONITORING WELL SAMPLING RESULTS

The second quarter analytical results for monitoring well sampling activities are presented according to well locations in either the upper or lower aquifer.

3.1 UPPER AQUIFER

Upper aquifer wells were sampled between March 24 and 28, 1997. All groundwater samples were analyzed for TCL and TAL (VOCs, SVOCs, PCBs and inorganic) parameters. Laboratory analytical reports for VOCs, SVOCs, and PCBs are presented in Appendix A. Laboratory reports for inorganic analytes are included in Appendix B.

3.1.1 VOCs

A summary of all VOC detections in upper aquifer monitoring wells sampled in March 1997 is presented in Table 6 (the wells listed on Table 6 are grouped by area rather than by numerical order). Figure 3 summarizes the VOC detections in Site monitoring wells. The following section focuses on the results of the March 1997 sampling event.

3.1.1.1 North Side. Monitoring wells MW37, MW38 and MW39 were sampled along the northern boundaries of the Site and MW48 and MW49 were sampled within the interior of the VOC plume in the area. Benzene and 1,1-dichloroethane were found in groundwater collected at MW39 at concentrations of 4 µg/L and 3 µg/L, respectively, and no VOC detections were observed at MW37 and MW38.

Benzene and chloroethane concentrations inside the contaminated area in MW48 in March 1997 were 5,200 µg/L and 620 µg/L, respectively. MW49 exhibited concentrations of 1,600 µg/L benzene, and 310 µg/L chloroethane in March 1997.

3.1.1.2 East Side. VOCs were not detected in monitoring wells MW11, MW40 and MW18 located along the eastern boundaries of the Site. Chloroethane was found in MW12 at 4 ug/L.

3.1.1.3 Southeast Area. VOCs were detected at MW6 and MW45 in the interior of the plume (Figure 3). The March 1997 data indicates that the concentrations of chloroethane, benzene and xylenes detected in MW6 continue to decline in this well:

Sampling Date	Chloroethane	Benzene	Total Xylenes
August 1989	140 ug/L	780/J ug/L	170 ug/L
May 1990	240 ug/L	1,500/J ug/L	210 ug/L
January 1995	530 ug/L	3000 ug/L	3,900 ug/L
November 1996	720 ug/L	320 ug/L	40 ug/L
March 1997	67 ug/L	35 ug/L	ND

In contrast to MW6, concentrations of chloroethane and benzene were observed to increase in MW45 between the November 1996 and March 1997 time interval:

Sampling Date	Chloroethane	Benzene
November 1996	82 J ug/L	530 ug/L
March 1997	230 ug/L	1100 ug/L

Future sampling data from MW45 will be used to evaluate the concentration variability in this well. However, surrounding wells in this area continue to indicate that the VOC plume is not expanding in this area of the Site. Low concentrations of benzene detected at MW15 (3 µg/L) and MW19 (5 µg/L), and the lack of VOCs detected at monitoring wells MW41, MW42, MW43, MW44, and MW47 indicate that the zone of contamination remains confined within the array of wells in the southeast area.

3.1.1.4 Wetland Area to the West. West of the Site, VOCs were detected at MW13 and MW46 and not detected at MW14. This is slightly different from the 1996 sampling results, when VOCs were found in MW13 and MW14, and not MW46. Concentrations of benzene and chloroethane fluctuated in water samples collected from the wetland area:

Well ID	Chloroethane	Benzene
MW13	330 ug/L	170 ug/L
MW14	ND	ND
MW46	ND	1 ug/L

3.1.1.5 Southwest Area. Upper aquifer monitoring wells, M-1S, M-3S and M-4S, were sampled in the Griffith landfill area in March 1997. VOCs were not detected at M-1S, and low concentrations of methylene chloride and acetone were detected in M-3S and an M-3S duplicate sample (Table 6). Chloroethane and benzene were detected in M-4S, located immediately west of the Off-Site Containment Area in the plume interior, at 1,300 ug/L and 98 ug/L, respectively.

3.1.2 SVOCs

A summary of the SVOC detections in upper aquifer wells in March 1997 is presented in Table 6. Phenol was detected in samples from nearly all upper aquifer monitoring wells at concentrations less than 35 ug/L (MW45). Most concentrations were less than 20 ug/L (Table 6). There is no remediation level for phenols listed in the ROD.

The largest number of SVOC analytes detected at an individual monitoring well was observed at MW45 where seven SVOCs were found in the water sample (Table 6). This well is known to be inside the contaminated upper aquifer area southeast of the Site. The highest concentration observed in this well was associated with naphthalene, which was detected at 120 ug/L. Other SVOCs were found in this well at levels less than 35 ug/L. Monitoring well M45 is an upper aquifer well located on the Griffith Landfill Site.

Other SVOC compounds detected in upper aquifer monitoring wells included bis(2-chloroethyl)ether, isophorone, 2,2'-oxybis(1-chloropropane), diethylphthalate and bis(2-ethylhexyl)phthalate which were found at maximum concentrations of 45 ug/L (M-4S), 2 ug/L (MW6), 140 ug/L (MW12), 4 ug/L (MW19) and 3 ug/L (MW43) (Table 6). The concentration of bis(2-chloroethyl)ether detected at M-4S exceeded the final remediation level in the ROD established for this compound (ROD level at 21 ug/L). All other SVOC detections were less than final remediation levels. The concentrations of SVOCs (other than phenol) detected in various monitoring wells were consistent with the historical detections and concentrations.

Tentatively identified compounds (TICs) were detected in some wells and are reported in Appendix A.

3.1.3 Pesticides and PCBs

Low concentrations of several pesticides (concentrations less than 0.076 ug/L) were detected in samples from five upper aquifer monitoring wells (Table 6). The detections of pesticides have been inconsistent throughout historical groundwater monitoring activities. Based on a review of the chromatograms, it appears that the pesticide detections may be associated with instrument noise during the analytical run and probably do not represent true concentrations at the Site. The reported concentrations were generally below or at the Contract Required Quantitation Limit (CRQL). This also may indicate that the detections are related to interferences in the samples and not Site related compounds.

PCBs were not detected in any of the upper aquifer groundwater samples collected during the March 1997 sampling event. This is consistent with the lack of PCB detections observed during previous monitoring periods.

3.1.4 Inorganic Parameters

A summary of the upper aquifer inorganics results is presented in Table 7. Because of the low turbidity achieved with the low flow sampling during previous sampling rounds, dissolved metals analyses were not conducted in March 1997 for any water samples. Therefore, all inorganic analyses are from unfiltered groundwater samples (analyses are for

total metals only; dissolved metals analyses were not conducted). Major groundwater constituents, calcium, magnesium, and sodium were generally detected at the highest concentrations in the upper aquifer, followed by detections of minor inorganic constituents, manganese, potassium and aluminum (Table 7). Other inorganic compounds apparently randomly detected in upper aquifer monitoring wells during March 1997 included arsenic, barium, cobalt, copper, lead, nickel, selenium, thallium and vanadium (Table 7).

Final remediation levels were established in the ROD for four metals: arsenic, beryllium, manganese and thallium. Arsenic was found in seven upper aquifer samples exceeding the remediation level for this constituent listed in Appendix B of the SOW. The highest arsenic concentrations was found at MW15 where arsenic was detected at 37.4 ug/L. Although this concentration is less than the arsenic level observed in November 1996 (63.6 ug/L), the arsenic concentrations exceeds the final remediation level (8.8 ug/L). Arsenic concentrations also exceeded the ROD remediation level at MW6, MW45, MW49, MW42, MW43, and MW44. Most of these wells are located in the southeast area within the limits of the VOC plume delineated in the area. The only exception to this trend is the detection of arsenic at 11 ug/L at MW49 which is located within the VOC plume limits in the north area of the Site.

The final remediation level for thallium (0.2 ug/L) was exceeded by MW48 where thallium was detected at 4 ug/L. MW 48 is inside the area of known VOC contamination north of the Site. Concentrations of manganese exceeded the final remediation level of 275 ug/L at 17 upper aquifer wells. No detections of manganese exceeded the upper bound final remediation level (3,300 ug/L).

3.2 LOWER AQUIFER

Laboratory analytical reports for VOCs, SVOCs, and PCBs are presented in Appendix C. Laboratory analytical reports for inorganics are included in Appendix D.

3.2.1 VOCs

A summary of VOC detections in lower aquifer monitoring wells during March 1997 sampling is presented in Table 6. Figure 4 summarizes the VOC detections in groundwater samples collected from lower aquifer monitoring wells.

The highest VOC concentrations observed in the lower aquifer continue to be observed at MW9 and MW10C. Chloroethane and benzene were observed in MW9 at 2,900 ug/L and 310 ug/L, respectively. The concentration of chloroethane detected in MW9 represented a slight increase from November 1996 (2,200 ug/L), whereas the concentration of benzene remained unchanged between the sampling periods (310 ug/L). Concentration of chloroethane detected at MW10C in March 1997 (140 ug/L) was similar to the level observed in November 1996 (120 ug/L).

The only other detectable VOCs in the lower aquifer were acetone, chloroform and toluene (Figure 4). Although these VOCs are common laboratory contaminants, they were not

eliminated in the validation process. Acetone was detected in samples from MW7, MW19, MW32, MW33, MW34, and MW53 at concentrations ranging between 5 ug/L (MW32) to 20 ug/L (MW7). Acetone was also detected in three out of four field blank samples (Table 6).

Infrequent low level detections of methylene chloride, chloroform and toluene were found in samples from MW10C, MW30, MW32, MW36 and MW55. Concentrations of these sporadic detections were never greater than 3 ug/L.

TICs were detected in samples collected from several lower aquifer wells and are listed in Appendix C.

3.2.2 SVOCs

Similar to the upper aquifer results, phenol was detected in many lower aquifer samples at concentrations ranging from 1 ug/L (MW22) to 180 ug/L (MW36) (Table 6). Other SVOCs were sporadically detected at lower aquifer monitoring wells:

Detected SVOC	Wells Detecting the SVOC	Maximum Concentration
Bis(2-chloroethyl)ether	MW9	38 ug/L
2-Methylphenol	MW55	2 ug/L
4-Methylphenol	MW53	1 ug/L
Isophorone	MW10C, MW33, MW551, MW53	2 ug/L
4-Chloro-3-methylphenol	MW55	4 ug/L
4-Nirolphenol	MW55	19 ug/L
Anthracene	MW51	0.7 ug/L
Bis(2-ethylhexyl)phthalate	MW29, MW30, MW31, MW34, MW36, MW50	56 ug/L (MW36)

The concentration of bis(2-chloroethyl)ether detected at MW9 (38 ug/L) exceeded the final remediation level set for this compound (21 ug/L).

The concentrations of bis(2-ethylhexyl)phthalate detected in samples from MW29, MW31, and MW36 also exceeded the final ROD level (8.8 ug/L). However, the detected concentrations of this compound were not consistent between the first and second quarter sampling events. In 1996, the highest detected concentrations of bis(2-ethylhexyl)phthalate were observed in samples from MW22 (48 ug/L), MW30 (68 ug/L) and MW32 (30 ug/L). In March 1997, groundwater samples from these same wells had non-detectable concentrations in MW22 and MW32, and only 2 ug/L in MW30. The fact that bis(2-ethylhexyl)phthalate was not consistently observed between sampling periods suggests that

this compound is a probable laboratory contaminant. Because bis(2-ethylhexyl)phthalate is a commonly used plasticizer for producing plastics such as polyvinyl chloride (*Handbook of Environmental Data on Organic Chemicals, Second Edition*, Verschueren, 1983), the low level detections of phthalates in water samples are not likely to represent actual groundwater conditions at the Site.

No other SVOCs were detected in monitoring well samples (Appendix C). TICs were detected in several wells and are listed in Appendix C.

3.2.3 Pesticides and PCBs

Low concentrations of two pesticides (less than 0.028 ug/L) were observed in MW33 and MW50 (Table 6). As discussed under Section 3.1.3, the pesticide detections were generally below or at the CRQL and may be related to interferences in the samples and not Site related compounds.

PCBs were not detected in any lower aquifer monitoring well samples (Appendix C).

3.2.4 Inorganic Parameters

Groundwater samples collected from lower aquifer wells in March 1997 were analyzed for total inorganics (Table 7). Major groundwater constituents, calcium, magnesium and sodium were detected at the highest concentrations in the lower aquifer, followed by detections of minor inorganic constituents, iron, potassium, manganese, and aluminum (Table 7). Other inorganics were generally detected at trace concentrations.

Arsenic was detected in three monitoring well samples (MW33, MW52 and MW54) above the final remediation level. The highest concentration was found in the sample from MW52 where arsenic was detected at 125 ug/L. Beryllium was detected in the sample from MW32 at 1.5 ug/L, which is above the remediation level of 0.02 ug/L. This was the only detection of beryllium in either the upper or lower aquifer at the Site in March 1997. Thallium was detected in the sample from MW24 at 4 ug/L, which is above the remediation level of 2.4 ug/L. No other detections of thallium were noted in the lower aquifer.

Manganese was detected in groundwater samples from four lower aquifer monitoring wells at concentrations slightly above the lower end of the final remediation level (275 ug/L). Concentrations in samples from MW52, MW53, located downgradient of the Site in the lower aquifer, and MW23 and MW50, located upgradient, ranged between 280 ug/L and 378 ug/L. All other manganese detections were less than the lower final remediation level.

4.0 SECOND QUARTER RESIDENTIAL WELL SAMPLING RESULTS

Residential wells were sampled between March 31 and April 2, 1997. All water samples were analyzed for TCL and TAL (VOCs, SVOCs, PCBs and inorganic) parameters and analyzed with low level detection methods. Laboratory analytical reports for residential well samples are presented in Appendix E.

4.1 SAMPLE IDENTIFICATION

Initially, residential well samples were labeled in a letter designation to denote an individual residence. However, due to the large number of wells comprising the residential well sampling program, it is hereby proposed to designate the residential wells by the numerical portion of their address rather than by letter. Following is a summary of the letter-denoted wells and their corresponding new well identification number:

Old Well Designation	New Well Identification Number
A	1007
B	1009
C	1029
D	1033
I	739
J	1008
K	1014
L	1026
N	420
RC	1130-C
RE	1130-E
RW	1130-W
S	1016
T	1043
U	1044
V	1046
W	1048
X	1009

4.2 SAMPLE LOCATION

A map showing the location of residential wells sampled in March/April 1997 is presented in Figure 5. At each residence, samples were collected from an outside tap wherever possible in order to collect a sample prior to treatment at the point of use. A summary of the sample collection details at each residence is included in Appendix G.

4.3 SAMPLING RESULTS

4.3.1 VOCs

A summary of all VOC detections in residential wells is presented in Table 8. Concentrations of VOCs less than 3 ug/L were observed in eight residential wells. Other than detections of 2-butanone in two wells at 3 ug/L, all other VOC detections were less than 0.4 ug/L. Vinyl chloride was detected in sample 1130-C (formerly PWRC-01) at 0.3 ug/L which exceeded the final remediation level established for this compound (0.25 ug/L).

4.3.2 SVOCs, Pesticides, PCBs

No SVOCs, Pesticides, or PCBs were detected in any of the residential well samples.

4.3.3 Inorganic Parameters

A summary of all inorganic detections in residential wells is presented in Table 9. Major and minor inorganic constituents were detected in groundwater samples collected at all residential wells (Table 9). With the exception of manganese detected in residential well sample 1014 (PWK-01) at 923 ug/L, no inorganic parameters exceeded final remediation levels.

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Table 1
Summary of Field Parameter Results
American Chemical Service, Inc. NPL Site
Griffith, Indiana

Well ID	Field Parameters				
	pH (std. units)	Conductivity ⁽¹⁾ (field measurement)	Conductivity ⁽¹⁾ (adjusted to 25°C)	Temperature (°C)	Turbidity (NTU)
MW1S	6.63	2330	3132	12.2	26.30
MW3S	6.71	1036	1476	10.1	74.00
MW4D	7.45	432	544	14.7	31.90
MW6	6.79	2437	3015	15.4	16.4
MW7	8.35	663	918	11.1	231.0
MW8	7.63	163	207	14.4	312.0
MW09	6.89	717	922	13.9	102.0
MW10C	6.92	1780	2457	11.2	306.0
MW11	6.31	337	507	8.3	90.4
MW12	6.47	464	659	10.2	153.0
MW13	6.83	896	1424	6.5	90.4
MW14	6.07	209	307	9.1	201.0
MW15	7.01	704	1008	9.9	19.4
MW18	6.76	875	1232	10.5	3.7
MW19	7.45	4944	6920	10.7	8.9
MW21	11.04	921	1272	11.2	38.6
MW22	8.43	2758	3691	12.4	15.4
MW23	7.07	801	1077	12.2	412.0
MW24	7.00	1146	1544	12.1	249.0
MW28	7.27	662	930	10.6	299.0
MW29	7.76	631	832	12.9	1.6
MW30	7.82	201	265	12.9	13.3
MW31	7.33	658	964	9.1	171.0
MW32	7.29	653	916	10.6	327.0
MW33	6.55	482	652	12.0	60.9
MW34	7.25	799	1111	11.0	21.9
MW36	7.94	250	357	10.1	78.2
MW37	6.29	281	451	6.1	102.0
MW38	6.4	239	365	7.7	119.0
MW39	6.8	1369	2037	8.6	213.0
MW40	6.47	144	216	8.4	112.0
MW41	6.91	3.03	4	9.2	207.0
MW42	6.86	1012	1450	9.9	782.0
MW43	6.83	848	1240	9.2	>1000
MW44	--	--	---	9.4	37.0
MW45	6.65	524	767	9.2	10.9
MW46	6.71	1069	1697	6.5	46.1
MW47	7.15	66.7	98	9.2	23.1
MW48	6.52	374	579	7.3	43.0
MW49	6.61	369	545	8.9	42.3
MW51	6.63	34	43	14.9	45.7
MW52	6.97	1630	2109	13.6	680.0
MW53	6.56	1510	2053	11.8	53.4
MW54	6.85	260	339	13.4	279.0
MW55	7.62	840	1196	10.1	52.5

Notes:

NTU = nephelometric turbidity units

(1) Conductivity shown in units of umhos/cm.

--- = data not collected

ACC/LP

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Table 2
Groundwater Elevations - March 1997
American Chemical Service, NPL Site

Lower Aquifer Wells

Location	Reference Points			3/24/97		Well Status
	East	North	TOIC	Depth	Elevation	
MW-7	6113	6732	641.46	16.86	624.60	Good Condition
PZ44	6170	6766	638.47	13.89	624.58	New Piezometer
MW36	6164	6768	637.85	13.27	624.58	New
MW-8	5934	7506	640.43	16.22	624.21	Good Condition
MW31	5907	7505	641.64	17.14	624.50	New
MW32	5902	7507	641.84	17.63	624.21	New
MW-9	4893	6990	639.05	14.35	624.70	Good Condition
MW29	4886	7012	638.06	13.37	624.69	New
MW34	4880	7002	638.14	13.42	624.72	New
MW-10	5200	7784	635.49	11.29	624.20	Good Condition
MW30	5194	7774	634.25	10.16	624.09	New
MW33	5189	7774	634.13	10.05	624.08	New
MW51	5198	7767	634.16	10.07	624.09	Installed October 16, 1996
MW-10C	5229	7554	637.45	12.84	624.61	In Sand Seam in Confining Layer
MW-21	4546	7067	633.76	9.12	624.64	Good Condition
MW-22	5208	4898	636.48	11.15	625.33	Good Condition
MW-23	4717	7404	633.31	8.77	624.54	Good Condition
MW-24	4596	8033	635.22	11.12	624.10	Good Condition
MW28	5657	5696	648.77	23.62	625.15	New
PZ42	5662	5696	648.44	23.28	625.16	New Piezometer
PZ43	5662	5702	648.69	23.52	625.17	New Piezometer
MW50	5269	5383	649.43	24.32	625.11	Installed October 17, 1996
ATMW-4D	5297	7311	637.99	13.55	624.44	ACS facility Well - LA
W-2	5292	7307	638.46	5.11	633.35	Lower Aquifer Well
M-1D	4359	5747	638.32	13.27	625.05	Griffith Landfill LA Well
M-2D	3997	6495	637.11	12.22	624.89	Griffith Landfill LA Well
M-3D	4144	6821	632.19	7.36	624.83	Griffith Landfill LA Well
M-4D	4949	6538	633.32	8.61	624.71	Griffith Landfill LA Well
MW35	4934	6542	634.50	--	--	Discovered Damaged
M-5D	4171	7094	634.18	9.43	624.75	Griffith Landfill LA Well
MW52	4996	7814	632.74	8.53	624.21	
MW53	4977	7833	632.87	8.70	624.17	
MW54	5590	7592	636.05	12.02	624.03	
MW55	5595	7604	636.63	12.56	624.07	

Table 2
Groundwater Elevations - March 1997
American Chemical Service, NPL Site

Upper Aquifer Wells

Location	Reference Points			3/24/97		Well Status
	East	North	TOIC	Depth	Elevation	
MW-2	5033	6839	638.05	4.83	633.22	Needs Repair - Still functional
MW-3	5299	7314	636.62	4.37	632.25	Moved
MW-4	6112	7126	641.05	5.38	635.67	Good Condition
MW-5	5788	6482	642.13	5.08	637.05	Good Condition
MW-6	5298	5520	655.28	20.50	634.78	Good Condition
MW-11	6377	7329	640.47	5.14	635.33	Good Condition
MW-12	6019	6352	642.74	6.59	636.15	Good Condition
MW-13	5050	7814	634.08	3.15	630.93	Good Condition
MW-14	4882	6995	638.56	6.62	631.94	Good Condition
MW-15	4721	5003	637.89	3.76	634.13	Good Condition
MW-16	5065	6596	638.52	6.21	632.31	Good Condition
MW-17	5656	5677	647.14	11.74	635.40	Good Condition
MW-18	5836	5746	644.89	8.25	636.64	Good Condition
MW-19	5231	4943	635.78	2.24	633.54	Good Condition
MW-20	5095	5028	642.98	9.15	633.83	Good Condition
AM-05	5224	6360	637.28	1.77	635.51	(Test Well)
Red Well	5204	6466	639.01	4.30	634.71	Good Condition
W-1	5305	7323	637.33	12.90	624.43	Good Condition

New Upper Aquifer Monitoring Wells

Location	Reference Points			3/24/97		Well Status
	East	North	TOIC	Depth	Elevation	
MW37	5395	7976	636.78	4.53	632.25	Installed Week of 7/15/96
MW38	5903	8216	636.51	4.28	632.23	Installed Week of 7/15/96
MW39	6253	7947	637.77	4.18	633.59	Installed Week of 7/15/96
MW40	6349	6831	639.46	3.35	636.11	Installed Week of 7/15/96
MW41	6242	4517	632.74	4.61	628.13	Installed Week of 7/15/96
MW42	6264	3808	632.32	5.09	627.23	Installed Week of 7/15/96
MW43	5880	3719	633.56	5.56	628.00	Installed Week of 7/15/96
MW44	5390	4303	633.04	2.80	630.24	Installed Week of 7/15/96
MW45	5830	4388	635.35	6.05	629.30	Installed Week of 7/15/96
MW46	4526	7424	633.32	2.52	630.80	Installed Week of 7/15/96
MW47	5958	5084	640.54	5.55	634.99	Installed Week of 7/15/96
MW48	5669	7814	636.36	3.94	632.42	Installed Week of 7/15/96
MW49	5551	7650	637.00	4.52	632.48	Installed Week of 7/15/96

Leachate/Upper Aquifer Landfill Wells

Location	Reference Points			3/24/97		Well Status
	East	North	TOIC	Depth	Elevation	
LW-1	4807	5070	644.57	10.33	634.24	Good Condition
LW-2	4662	5465	649.70	15.35	634.35	Good Condition
M-1S	4362	5743	639.09	4.47	634.62	Good Condition
M-2S	3999	6491	637.12	6.91	630.21	Good Condition
M-3S	4142	6819	631.88	1.53	630.35	Good Condition
M-4S	4953	6537	633.42	3.15	630.27	Good Condition
M-5S	4170	7089	634.17	4.11	630.06	Good Condition

Table 2
Groundwater Elevations - March 1997
American Chemical Service, NPL Site

Staff Gauges

Location	Reference Points			3/24/97		Well Status
	East	North	TOSG	Depth	Elevation	
SG-1	5023	6196	633.50	1.76	631.74	Re-Installed Week of 3/24/97
SG-2	4423	6864	622.84	--	---	Re-Installed 5/22/97 by surveyor
SG-3	4180	7123	631.17	*	*	Re-Installed Week of 3/24/97
SG-4	5228	6611	635.73	*	*	Re-Installed Week of 3/24/97
SG-5	5464	7713	633.36	2.65	630.71	Re-Installed Week of 3/24/97
SG-6	4495	8075	632.97	2.13	630.84	Re-Installed Week of 3/24/97
SG-7	5403	6889	637.01	*	*	Re-Installed Week of 3/24/97
SG-9	3846	6336	632.42	*	*	Re-Installed Week of 3/24/97
SG-10	6748	7238	637.29	1.49	635.80	Re-Installed Week of 3/24/97
SG-8R	5409	5252	634.70	0.64	634.06	Re-Installed Week of 3/24/97
SG-11	5859	8245	634.62	2.90	631.72	Re-Installed Week of 3/24/97
SG-12	5596	7867	634.12	2.96	631.16	Re-Installed Week of 3/24/97

Piezometers

Location	Reference Points			3/24/97		Well Status
	East	North	TOC	Depth	Elevation	
P-1	5700	6365	642.84	6.83	636.01	Good Condition
P-2	5577	6165	645.57	--	--	Eliminated
P-3	5453	6470	639.87	4.19	635.68	Good Condition
P-4	5432	6228	639.25	3.51	635.74	Good Condition
P-5	5285	6510	636.70	1.80	634.90	Buried in Brush
P-6	5150	6551	638.75	--	--	Not found, possibly destroyed
P-7	5950	6630	643.63	7.50	636.13	Good Condition
P-8	6156	6734	639.27	3.05	636.22	Good Condition
P-9	6134	6994	638.88	3.10	635.78	Good Condition
P-10	5413	5852	649.32	13.98	635.34	Top of inner casing cracked
P-11	5199	5900	649.14	13.65	635.49	Bent, product present
P-12	5076	5723	650.08	--	--	Product in Piezometer
P-13	4878	5735	651.20	16.30	634.90	Good Condition
P-14	5014	5914	645.33	10.77	634.56	New
P-15	5003	6187	639.93	7.52	632.41	New
P-16	4673	5749	648.80	13.80	635.00	New
P-17	4584	6006	654.64	20.29	634.35	New - Inside Griffith Landfill
P-18	4623	6224	649.84	7.69	642.15	New - Inside Griffith Landfill
P-19	4977	5043	639.71	5.74	633.97	Good Condition
P-20	5104	6233	643.10	--	--	Damaged
P-21	4569	6537	632.82	--	--	Could not find
P-22	4636	6732	634.30	4.68	629.62	Good Condition
P-23	4689	7018	636.18	5.25	630.93	Good Condition
P-24	5002	7178	636.06	3.83	632.23	Good Condition
P-25	5131	7510	635.01	3.45	631.56	Re-Installed 10-25-95
P-26	4764	7309	634.23	3.46	630.77	Good Condition
P-27	4904	7020	639.70	7.63	632.07	Good Condition
P-28	5883	7486	644.53	9.66	634.87	Good Condition
P-29	5738	6619	642.37	--	--	Product in piezometer
P-30	5626	6793	642.42	--	--	Product in piezometer
P-31	5480	7159	641.03	6.73	634.30	Good Condition
P-32	5746	7026	642.32	6.95	635.37	Re-Installed 10-27-95
P-33	5226	7129	640.20	5.81	634.39	Re-Installed 10-27-95
P-34	5279	6692	639.46	4.81	634.65	Good Condition
P-35	5515	6572	641.44	5.63	635.81	Re-Installed 10-27-95
P-36	5410	6851	645.89	10.77	635.12	Re-Installed 10-27-95
P-37	5330	6949	641.37	--	--	Destroyed

Table 2
Groundwater Elevations - March 1997
American Chemical Service, NPL Site

Piezometers (Cont'd.)

Location	Reference Points			3/24/97		Well Status
	East	North	TOC	Depth	Elevation	
P-38	5149	6992	639.87	--	--	Eliminated
P-39	5940	6902	642.00	6.20	635.80	New
P-40	5880	7229	640.10	5.19	634.91	Good Condition
P-41	5702	7353	638.82	4.48	634.34	Good Condition
P-49	5119	6951	638.96	5.08	633.88	Old P-51
P-50	5129	6964	639.59	6.26	633.33	Good Condition
P-51	3876	6859	635.07	5.04	630.03	Installed 10-25-95
P-52	4100	7845	636.66	5.77	630.89	Revised 2-15-96)
P-53	4597	8015	636.18	5.41	630.77	Installed 10-24-95
P-54	4936	8081	638.28	6.34	631.94	Installed 10-2-95
P-55	5628	7979	636.08	4.31	631.77	Installed 10-25-95
P-56	6405	7665	639.46	4.43	635.03	Installed 10-23-95
P-57	6783	7573	638.05	2.85	635.20	Installed October 16, 1996
P-58	6454	6932	638.30	2.50	635.80	Installed 10-24-95
P-59	6389	6590	639.22	2.95	636.27	Installed 10-24-95
P-60	6111	6051	640.23	3.91	636.32	Installed 10-26-95
P-61	5533	5284	638.58	4.52	634.06	Installed 10-24-95
P-62	5665	4945	637.06	4.32	632.74	Installed 10-24-95
P-63	5483	7689	637.70	5.73	631.97	Installed 10-23-95
EW-1	5113	6942	639.50	5.80	633.70	Good Condition

New Piezometers - Wetlands

Location	Reference Points			3/24/97		Well Status
	East	North	TOC	Depth	Elevation	
P-64	4617	7065	634.87	4.15	630.72	Screen @ top of upper aquifer
P-65	4615	7063	634.77	3.97	630.80	Screen @ base of upper aquifer
P-66	4729	7034	636.02	4.99	631.03	Screen @ top of upper aquifer
P-67	4732	7034	636.06	5.05	631.01	Screen @ base of upper aquifer
P-68	4743	7752	634.48	3.76	630.72	Screen @ top of upper aquifer
P-69	4741	7751	634.66	3.88	630.78	Screen @ base of upper aquifer
P-70	4880	7680	635.38	4.70	630.68	Screen @ top of upper aquifer
P-71	4876	7682	635.32	4.46	630.86	Screen @ base of upper aquifer

Notes

All depth measurements and elevations are in units of feet.

* Depth to water data has been lost.

-- Depth measurements could not be measured - see note under "Well Status"

Table 3
Vertical Gradients in Wetlands - March 1997
American Chemical Service, Inc. NPL Site
Griffith, Indiana

Piezometer Nest	Screen Interval		Screen Midpoint	Separation (feet)	Groundwater Elevation			Hydraulic Gradient
	Top	Bottom			Upper	Lower	delta	
P64	629.05	624.10	626.58	5	630.72			
P65	622.20	620.20	621.20			630.80	0.08	0.02
P66	629.45	625.10	627.28	8	631.03			
P67	620.50	618.50	619.50			631.01	-0.02	0.00
P68	628.15	623.80	625.98	6	630.72			
P69	621.10	618.60	619.85			630.78	0.06	0.01
P70	628.55	624.20	626.38	6	630.68			
P71	621.00	619.00	620.00			630.86	0.18	0.03

Notes:

(-) = Downward Vertical Gradient

Positive number in final column indicates upward gradient

Water Levels Collected by Montgomery Watson on March 24, 1997.

Table 4
Vertical Gradients in Lower Aquifer - March 1997
American Chemical Service, Inc. NPL Site
Griffith, Indiana

Well Nest	Screen Interval		Separation (feet)	Lowest Measurable Gradient (1)	Groundwater Elevation					Vertical Gradients			
	Top	Bottom			Upper (1)	Upper	Middle	Lower	delta	Upper(2)/ Upper	Upper/ Middle	Middle/ Lower	Upper/ Lower
MW7	595.9	590.9			NA	624.60				NA			
PZ44	578.4	573.4	13	0.0008			624.58		-0.02		-0.002		
MW36	552.7	542.7	21	0.0005				624.58	0			0.0000	-0.0006
MW8	598.2	593.2			NA	624.21				NA			
MW31	574.6	564.6	19	0.0005			624.50		0.29		0.0153		
MW32	547.3	537.3	17	0.0006				624.21	-0.29			-0.0171	0.0000
MW9	605.9	600.9			NA	624.70				NA			
MW29	585.9	575.9	15	0.0007			624.69		-0.01		-0.001		
MW34	552.8	542.8	23	0.0004				624.72	0.03			0.0013	0.0005
MW51	611.9	601.9			624.09								
MW10	603.0	598.0	0	NC		624.20			0.11	NC			
MW30	585.0	575.0	13	0.0008			624.09		-0.11		-0.008		
MW33	556.0	546.0	19	0.0005				624.08	-0.01			-0.0005	-0.0003 (3)
MW28	588.7	578.7			NA	625.15				NA			
PZ42	568.5	563.5	10	0.0010			625.16		0.01		0.001		
PZ43	554.5	549.5	9	0.0011				625.17	0.01			0.001	0.0010
MW52	615.6	605.6			NA	624.21				NA			
MW53	555.7	545.7	50	0.0002			NA	624.17	-0.04		NA	NA	-0.0008
MW54	608.1	598.1			NA	624.03				NA			
MW55	547.6	537.6	51	0.0002			NA	624.07	0.04		NA	NA	0.0008

Notes:

(-) = Downward Vertical Gradient

Positive values for vertical gradient indicate upward vertical gradient.

Water Levels Collected by Montgomery Watson on March 24, 1997.

NA = Not Applicable. Calculating vertical gradient only for upper/lower interval at this location.

NC = Not calculable. Well screens overlap between nested wells; therefore no vertical separation distance.

(1) Lowest measurable gradient calculated by dividing the potential measurement error (0.01 foot) by the vertical separation distance.

Bolded vertical gradients indicate those values which exceed the lowest measurable gradient and are distinguishable from zero.

(2) Additional well (MW51) installed at MW10/MW30/MW33 nest on October 16, 1996.

(3) Vertical gradient calculated between uppermost well (MW51) and lowermost well (MW33).

Table 5
Vertical Gradients Between Upper and Lower Aquifers
March 1997
American Chemical Service, Inc. NPL Site
Griffith, Indiana

Well Designation	Screen Interval		Screen Midpoint	Separation (feet)	Groundwater Elevation			Hydraulic Gradient
	Top	Bottom			Upper	Lower	delta	
P28	634.30	629.30	631.80	11	634.87			
MW8	598.20	593.20	595.70			624.21	-10.66	-1.0
P27	631.02	626.02	628.52	8.5	632.07			
MW9	605.90	600.90	603.40			624.70	-7.37	-0.87
P8	635.36	630.36	632.86	18	636.22			
MW7	595.90	590.90	593.40			624.60	-11.62	-0.65
MW17	632.94	622.94	627.94	28	635.40			
MW28	588.70	578.70	583.70			625.15	-10.25	-0.37

Notes:

(-) = Downward Vertical Gradient

(+) = Upward Vertical Gradient

Water levels collected by Montgomery Watson on March 24, 1997.

Table 6
Summary of Detected Organic Compounds in Monitoring Wells
March 1997 Sampling Round
ACS Site
Griffith, Indiana

Sample ID	Remediation Level	LOWER AQUIFER WELLS																		
		Downgradient																	Sidegradient	
		MW08-01	MW09-01	MW10C-01	MW34-01	MW29-01	MW30-01	MW31-01	MW32-01	MW33-01	MW34-01	MW35-01	MW36-01	MW37-01	MW38-01	MW39-01	MW40-01	MW41-01	MW42-01	MW43-01
DATE	Level	3/25/97	4/2/97	3/26/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97	3/25/97
Parameter	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
VOLATILES																				
Chloroethane			2900	140																
Methylene Chloride	5.0			1																
Acetone	2,300 - 192								5	6	7			8	11				30	
1,1-Dichloroethane	2,200 - 183																			
1,2-Dichloroethane (total)	330 - 28 (cis)						1											1		
Chloroform																				
Benzene	5.0		318																	
Toluene									3											1
Chlorobenzene																				
Xylene (total)																				
SEMIVOLATILES																				
Phenol		54	36	15	16	3	21	100	75	80		79	19	24	86	28	20	38	70	32
Isopropyl Chloroethylether	21.0		38																	184
1,4-Dichlorobenzene	3.3																			
1,2-Dichlorobenzene																				
2-Methylphenol																		2		
2,2-Dimethyl-1-Chloropropene																				
4-Methylphenol	1,700 - 142									1				0.6		2	1			
Isopropylene	19			0.9																
Naphthalene																				
4-Chloro-3-methylphenol																		4		
2-Methylnaphthalene																				
Dimethylnaphthalene																				
4-Nitrophenol																		19		
Dimethylnaphthalene																				
Anthracene																				
Isopropyl Ethylether	5.8					18	2	9			5	2		0.7						54
PESTICIDES/PCBs																				
alpha-BHC	0.06 (PCBs)									0.028										
beta-BHC																				
Heptachlor																				
4,4'-DDT																				
Methoxychlor																				
gamma-Chlordane																				
Notes																				

All results in ug/L.
 A blank indicates not detected.
 Bold type face indicates detection exceeds remediation level.

Table 6
Summary of Detected Organic Compounds in Monitoring Wells
March 1997 Sampling Round
ACS Site
Griffith, Indiana

[illegible]

All results in $\mu\text{g/l}$
A blank indicates not detected
Bold type for end uses detection
exceeds remediation level

Table 6
Summary of Detected Organic Compounds in Monitoring Wells
March 1997 Sampling Round

ACS Site
Griffith, Indiana

Sampled	Remediation Level	UPPER AQUIFER WELLS						FIELD BLANKS			
		Southwest			Westend						
DATE	Level	MW01S-01 3/26/97	MW02S-01 3/26/97	MW03S-01 3/26/97	MW13-01 3/25/97	MW14-01 3/25/97	MW46-01 3/25/97	FB01-01 3/26/97	FB02-01 3/26/97	FB03-01 3/27/97	FB04-01 4/5/97
Parameter	ug/L	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
VOLATILES											
Chloroethane			3	6	330					9	
Methylene Chloride	5.0										
Acetone	2,300 - 192			7				8		6	19
1,1-Dichloroethane	2,200 - 183										
1,2-Dichloroethane (total)	330 - 28 (cls)										
Chloroform											
Benzene	5.0				179		1			2	
Toluene											
Chlorobenzene											
Xylene (total)											
SEMIVOLATILES											
Phenol			2	11	8		8				3
Isopropyl Alcohol	21.0		1	1			3				
1,4-Dichlorobenzene	3.3										
1,2-Dichlorobenzene											
2-Methylphenol											
2,3-Dimethylphenol											
4-Methylphenol	1,700 - 142										
Naphthalene	19			0.6							
Naphthalene											
4-Chloro-3-methylphenol											
2-Methylnaphthalene											
Dimethylnaphthalene											
4-Nitrophenol											
Dimethylnaphthalene											
Acetanilide											
Isopropyl Alcohol	5.8										
PESTICIDES/PCBs	0.06 (PCBs)										
alpha-BHC											
gamma-BHC											
Heptachlor											
4,4'-DDT			0.012								
Methoxychlor	0.076										
Gamma-Chlorane											

Notes
 All results in ug/L.
 A blank indicates not detected.
 Bold type face indicates detection
 exceeds remediation level

Table 7
Summary of Detected Inorganic Compounds in Monitoring Wells
March 1997 Sampling Round ACS Site
Griffith, Indiana

		LOWER AQUIFER WELLS																			
SAMPLE ID	Remediation	Downgradient																Sidegradient			
		MW04-D-01	MW06-D-01	MW09-D-01	MW10C-D-01	MW24-D-01	MW29-D-01	MW30-D-01	MW31-D-01	MW32-D-01	MW33-D-01	MW34-D-01	MW51-D-01	MW52-D-01	MW53-D-01	MW53-D-01	MW54-D-01	MW55-D-01	MW07-D-01	MW21-D-01	MW16-D-01
SAMPLE DATE:	Level	3/27/97	3/25/97	4/2/97	3/27/97	3/25/97	3/26/97	3/25/97	3/25/97	3/26/97	3/26/97	3/26/97	3/26/97	3/26/97	3/26/97	3/25/97	3/25/97	3/25/97	3/25/97	3/26/97	3/26/97
Parameter	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
METALS																					
Aluminum			612	2580		1100			739	10200		1140	403	1030	265	271	1340		1630	2480	719
Antimony																					
Arsenic	8.8			6.8							22.5			125		9.8	3.8				
Barium		204	98.6	301	372	186	26.7	57.6	228	258	1340	165	455	369	1410	1380	145	115	138	196	140
Beryllium	0.02									1.9											
Cadmium				2.4																	
Calcium		99100	46800	135000	122000	114000	59400	56700	85600	77700	313000	62200	153000	199000	222000	222000	113000	47600	113000	96400	86580
Chromium		1.3	20.6	45	3.6	13.9	5.1	12.2	42.2	63.3	3.6	24.9	3.7	248		11.9	7.8	94.3	38.9	18.7	22.4
Cobalt				9.3	2.1	1.4		2.1	2.2	3.2	3.6	2.4	1.4	8.3	5.2	5.1	2.3	1.6	2.3	4.2	1.1
Copper				25.8	5.9	14	14.7	6.1	51.7	28	4.8	22.1	4.5	22.5		91	105	16.4	13.4	16.2	33.8
Iron		1900	2950	20700	9080	7890	335	252	5530	14600	28300	3520	8470	9320	21300	18600	3240	6790		11700	4530
Lead			3.4	6.7	1.8	3.9	2.1	1.4	4.8	11	1.0	1.9	2.6	8.9	1.1	1.0	6.0	2.8	5.8	28.1	7.6
Magnesium		45600	14700	28000	58300	28300	26100	21000	30900	48000	70500	48400	67600	52800	108000	107000	47900	24200	30000	4300	23100
Manganese	3.300 - 275	36.5	102	249	73.8	239	86	240	126	146	111	67.5	118	378	321	318	130	100	219	23.5	361
Mercury				0.67																	
Nickel		3.3		37.9	7.7		30.6	31.5			19.8	28.9	8.0	124		12.7	22.9		6.9		
Potassium		4490	1260	9140	4700	2020	5090	2520	2100	5020	14300	4780	3450	4120	28800	28000	2340	7180	2660	9180	4090
Sodium		78300	10200	82600	185000	93600	39800	21100	17500	36900	195000	34900	114000	152000	342000	337000	16700	109000	18900	36200	73400
Thallium	2.4 - 0.2					4															
Vanadium			1.2	9.6		2.7				1.4	5.6				2.8		2.1		3.4		6.9
Zinc																	31.4				

Notes
All results in ug/l.
A blank indicates not detected.
Bold type face indicates detection exceeds remediation level

Table 7
Summary of Detected Inorganic Compounds in Monitoring Wells
March 1997 Sampling Round ACS Site
Griffith, Indiana

		LOWER AQUIFER WELLS				UPPER AQUIFER WELLS													
		Upgradient				East				North				Plume Interior					
SAMPLEID	Remediation	MW22-01	MW28-01	MW50-01	MW50-91	MW11-01	MW12-01	MW18-01	MW40-01	MW37-01	MW38-01	MW39-01	MW06-01	MW45-01	MW45-91	MW48-01	MW49-01	MW15-01	
SAMPLEDATE	Level	3/27/97	3/25/97	3/26/97	3/26/97	3/25/97	3/25/97	3/27/97	3/26/97	3/25/97	3/26/97	3/25/97	4/3/97	4/2/97	4/2/97	3/27/97	4/3/97	4/3/97	
Parameter	ug/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	NR/L	
METALS																			
Aluminum			2650	8320	6880	1470	2030		2040			791	530		148	378		258	472
Antimony														1.2			1.5	2	1.3
Arsenic	8.8		2.4				7.6						18.7	16.6	15.1	6.4	11	37.4	
Barium		580	131	314	308	21.3	83.0	33.6	26.6	17	28	95.2	182	117	125	125	56	1240	
Beryllium	0.02																		
Cadmium							1.5												
Calcium		238000	96300	191000	182000	38300	45900	88500	14700	32700	30600	118000	177000	120000	129000	133000	50700	78800	
Chromium		9.7	108	18.4	17.3	2.9	12	29.8	4.1	2.5		6.4	19.7	11.8	16.2	1.9	2.2	4.9	
Cobalt			5.2	7.3	6.1	2.2	2.4		3.1	4.4	2.1	1.2	3.6	4.2	4.2	2.6	2.4	4.1	
Copper		3.8	55.1	41.4	33.7		16.8	2.8					51.7	47.7	98.7			26.1	
Iron		389	7030	14300	12000	2010	30100	165	3470	1850	12800	17300	1590	11400	11500	24900	9050	5550	
Lead		5.2	11.6	8.9	7	5.3	10.9	1.5	7.3	4.5	8.3	3.5	1.2		1.9			1.2	
Magnesium		41500	41400	87800	84200	16300	17500	27300	6160	10800	10100	20600	32200	32200	33400	19600	7200	73600	
Manganese	3.300 - .275	16	155	288	238	139	1898	83.4	296	165	250	876	486	688	698	618	818	276	
Mercury																			
Nickel		10.9	74.2	26.5	24.1	7.4	12.6	3.3		5.3			33.2	15.9	19.1	13.5	9.7	19.2	
Potassium		17600	3040	21200	20300	1880	2860	2420	1270	1300		6610	24100	7230	7720	6860	1600	(10200)	
Sodium		242000	15300	368000	351000			64600	7800		4190	118000	449000	101000	102000	46300	12300	311000	
Thallium	2.4 - 0.2															4.8			
Vanadium			5.7	13.9	11.5	3.8	23.7		4.3	1.2	10.4	1.7				2.4			
Zinc				45.4	39.5			13.9											

All results in $\mu\text{g/l}$.

A blank indicates not detected.
 Bold type face indicates detection exceeds remediation level

Table 7
Summary of Detected Inorganic Compounds in Monitoring Wells
March 1997 Sampling Round ACS Site
Griffith, Indiana

SAMPLE ID	Remediation Level	UPPER AQUIFER WELLS													FIELD BLANKS			
		Southeast							Southwest			Wetland			FB01-01	FB02-01	FB03-01	FB04-01
		MW19-01	MW41-01	MW42-01	MW43-01	MW44-01	MW44-91	MW47-01	M45-01	MW015-01	MW035-01	MW035-91	MW13-01	MW14-01	MW46-01			
SAMPLE DATE	Level	3/27/97	3/26/97	3/26/97	3/26/97	3/26/97	3/26/97	3/27/97	3/27/97	3/26/97	3/27/97	3/26/97	3/27/97	3/27/97	3/25/97	3/25/97	3/27/97	4/3/97
Parameter	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
METALS																		
Aluminum		322	1040	752	10100	394	368	533	548				96	2550		150	54.6	13.7
Antimony							1.1											
Arsenic	8.8			14.5	4.6		12.6		4						2.1		2.2	
Barium		666	30.7	83.3	88.3	115	123	8.2	553	562	280	257	54.9	33.2	129	1.8	1.4	
Beryllium	0.02																	
Cadmium									1.0	1.0					1.1			
Calcium		72700	36300	133000	128000	90900	97100	7330	358000	270000	120000	109000	103000	26100	114000	49.6	174	14.3
Chromium		5.5	6.8	4.9	25.5	2.3	2.0	2.3	67.8	1.8				11.9	5.3			
Cobalt		1.6		1.8	12.9				8.2	2.3	2.9	2.3		2.5	1.8			
Copper		4.9	16	18.9	44.6	3.9	4.9			1.2	2.5	2.2				2.4	2.6	2.4
Iron		4630	1170	9920	29200	2170	2390	405	28300	23600	2880	2670	6090	5610	17800	150	22.9	1.6
Lead			15	2.8	21.3	1.1	1.4	2.3	6.1					17				
Magnesium		65000	11300	49000	55000	37100	59800	2070	57300	88800	47000	42700	27800	6830	32400	439	113	22.3
Manganese	3,300 - 275	165	324	796	666	46	48.7	8.3	883	704	1248	1179	697	59.7	1359		1.2	
Mercury																		
Nickel		19.3		6.6	28.7	3.8	3.9	1.3	74.6	7.5	11.7	10.4		9.3	5.4		1.9	
Potassium		114000		1380	4230	1260	1310	590	30000	42800	21200	19100	1900	2770	1280	215	144	
Sodium		975000	5950	14700	9210	20200	21400	2120	98800	81200	30400	27800	30700	3610	74900			
Thallium	2.4 - 0.2																	
Vanadium			3	2.2	25.1				3.5	3.0				6.4	1.5			
Zinc																16.7	13.4	7.6

Notes

All results in ug/L.

A blank indicates not detected.

Bold type face indicates detection

exceeds remediation level

March 1997 Sampling Round

SAMPLE ID	Remediation	PWA-01	PWB-01	PWC-01	PWD-01	PWE-01	PWF-01	PWG-01	PWH-01	PWI-01	PWJ-01	PWK-01	PWL-01	PWN-01	PWR-01	PWS-01	PWT-01	PWU-01	PWV-01	PWW-01	PWX-01	PWTB01-01	PWTB02-01	
SAMPLE DATE	Level	4/1/97	3/31/97	3/31/97	4/1/97	3/31/97	3/31/97	3/31/97	3/31/97	3/31/97	4/1/97	3/31/97	4/2/97	4/1/97	4/1/97	4/1/97	3/31/97	3/31/97	4/1/97	4/1/97	4/1/97	4/1/97	3/31/97	3/1/97
Parameter	(ug/L)	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	
VOLATILES																								
Acetone	2,300 - 192																					3	14	
2-Butanone	24,000-2,000												3		3									
Chlorobenzene	--																						0.3	
Chloromethane	8.4										0.3												0.2	
1,4-Dichlorobenzene	3.3												0.3											
1,2-Dichloroethane	--							0.1																
Toluene	--					0.4	0.2																	
Trichloroethene	5.0										0.3													
Vinyl Chloride	0.25												0.3		0.2									

SEMIVOLATILES

No Detections

PESTICIDES

No Detections

All results in ng/l

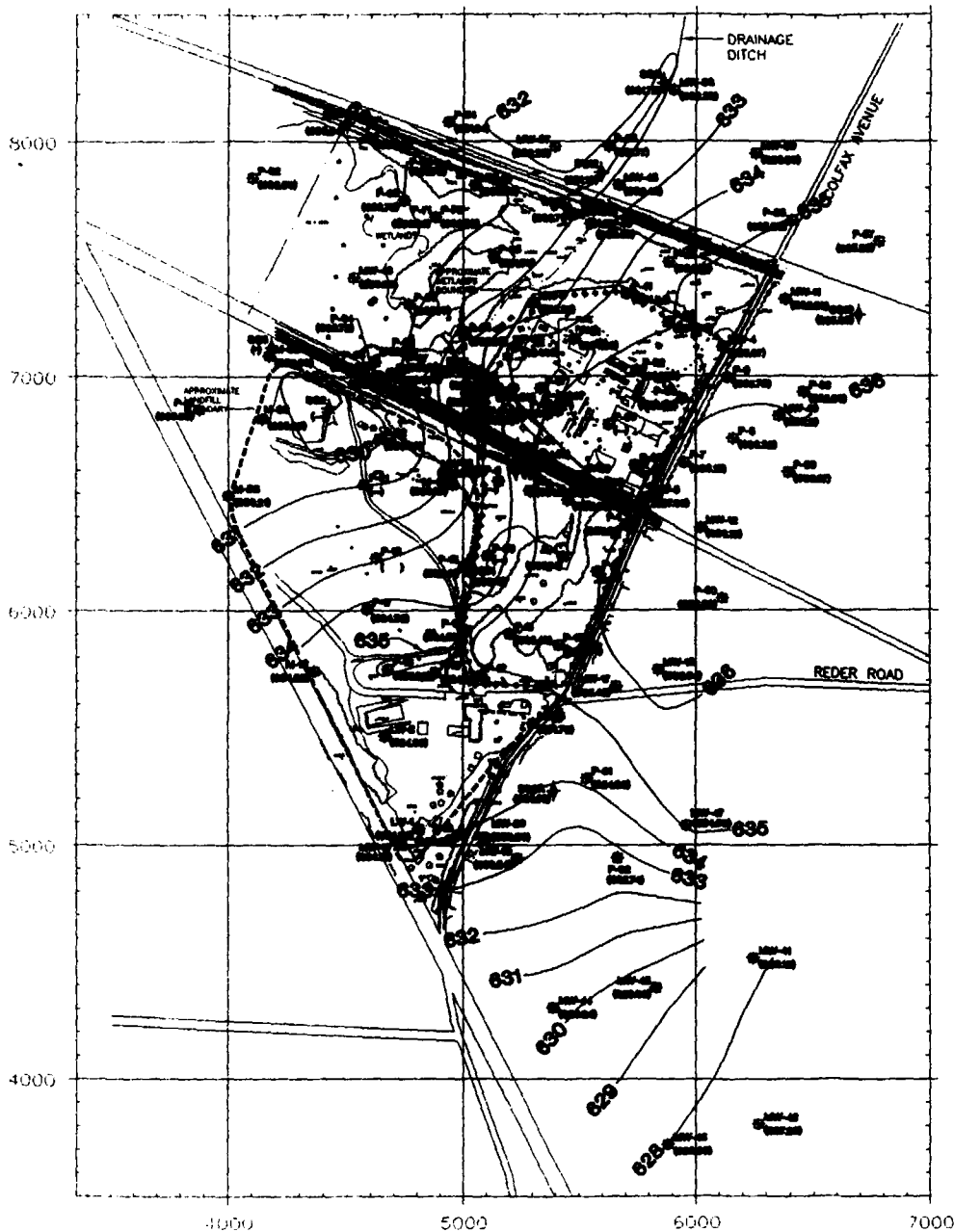
A blank indicated not detected

Table 9
Summary of Detected Inorganic Compounds in Residential Wells
March 1997 Sampling Round
ACS Site
Griffith, Indiana

SAMPLE ID	Remediation Level	PWA-01	PWB-01	PWC-01	PWD-01	PWE-01	PWF-01	PWG-01	PWH-01	PWI-01	PWJ-01	PWK-01	PWL-01	PWM-01	PWN-01	PWO-01	PWP-01	PWQ-01	PWR-01	PWS-01	PWT-01	PWU-01	PWV-01	PWW-01	PWX-01
Parameter	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
METALS																									
Aluminum	...																								
Antimony	...																					1.4			1.7
Arsenic	8.8												2.8							3.8					
Barium		119	121	166	157	157	159	170	39.7	160	7.9	183	184	196	207	147	178	215	166	188	142				
Beryllium	0.02																								
Cadmium	...				1.1																				
Calcium	...	93400	91200	93200	96800	103000	104000	104000	94900	102000	35000	95300	91400	96200	114000	95900	120000	97000	95500	119000	105000				
Chromium	...																								
Cobalt	...																								
Copper	...			31.5	155		30.2		13.1	1							19.9				51.2	59.6	43.6	24.5	
Iron	...	2870	2170	3030	3190	1440	1480	2730	33.5	3090	81.8	2000	2120	2250	3060	2220	2750	2720	2380	3590	3520				
Lead	...			1.9	22.6		1.1	3.2									4.0				4	11.4	4.1	1.3	
Magnesium	...	43500	42700	53700	50900	61200	61900	64600	33900	62000	14100	53400	48500	51300	40800	57000	57800	44000	50700	48600	69600				
Manganese	3,300 - 275	53.6	56.2	35.3	48.1	153	151	23.4	923	26.5		17.1	30.9	32.8	60.5	26.3	47.2	36.9	40.6	101	23.1				
Mercury	...																								
Nickel	...	2.5	3.3		3.7	1.1	1.4		2.8								5.0		2.5						
Potassium	...	1860	1760	2730	2660	4740	4940	3620	3760	3320	1840	3050	3020	3250	3850	3000	3060	5140	3160	2660	3860				
Selenium	...																								
Silver	...																								
Sodium	...	15600	14200	23300	22300	155000	174000	29800	117000	27000		28500	29100	31400	49500	25800	28100	21800	25900	27800	32000				
Thallium	2.4 - 0.2																								
Vanadium	...																								
Zinc	...	121		78.6	1580		39			32.6	92.7							60.2		441	31.1				
Cyanide	...																								

Notes:
All results in ug/L.





LEGEND

- UPPER AQUIFER WELL LOCATION AND NUMBER
- LEACHATE/UPPER AQUIFER WELL LOCATION AND NUMBER
- PIEZOMETER LOCATION AND NUMBER
- STAFF GAUGE LOCATION AND NUMBER
- MEASURED WATER TABLE ELEVATION, IN FT. AMSL
- NOT MEASURED
- 630 — GROUNDWATER ELEVATION CONTOUR
- NEW ALIGNMENT OF BARRIER WALL

NOTES

1. GROUNDWATER LEVELS FOR WATER TABLE CONTOURS WERE MEASURED AT THE SITE ON MARCH 24, 1997.

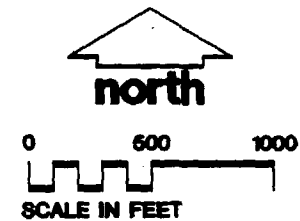
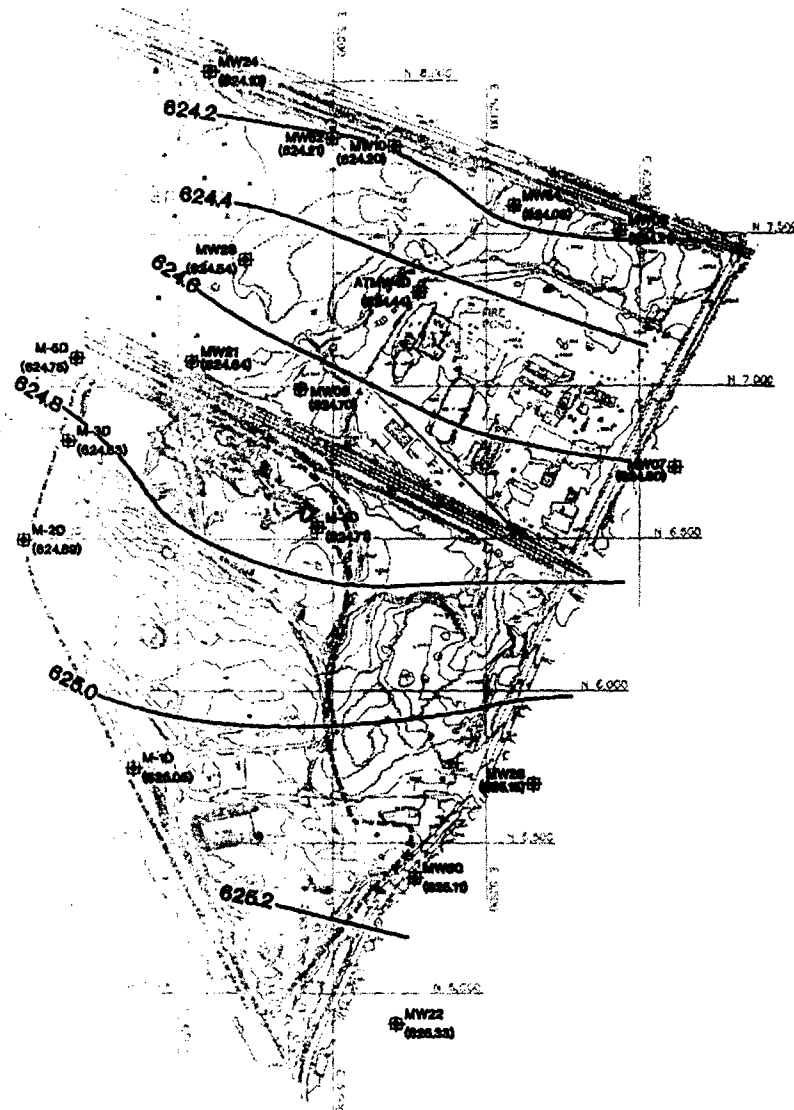


FIGURE 1

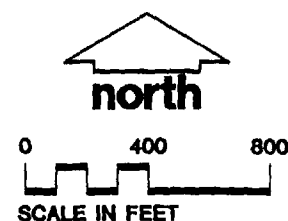


LEGEND

- MW00 LOWER AQUIFER MONITORING WELL LOCATION AND NUMBER, SHOWING MEASURED GROUNDWATER ELEVATION
- PZ48 PIEZOMETER LOCATION AND NUMBER
- 624.70 MEASURED WATER TABLE ELEVATION, IN FT. AMSL
- 625.0 GROUNDWATER ELEVATION CONTOUR

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC. CONTOUR INTERVAL = 2 ft.
2. GROUNDWATER LEVELS FOR WATER TABLE CONTOURS WERE MEASURED AT THE SITE ON MARCH 24, 1997.



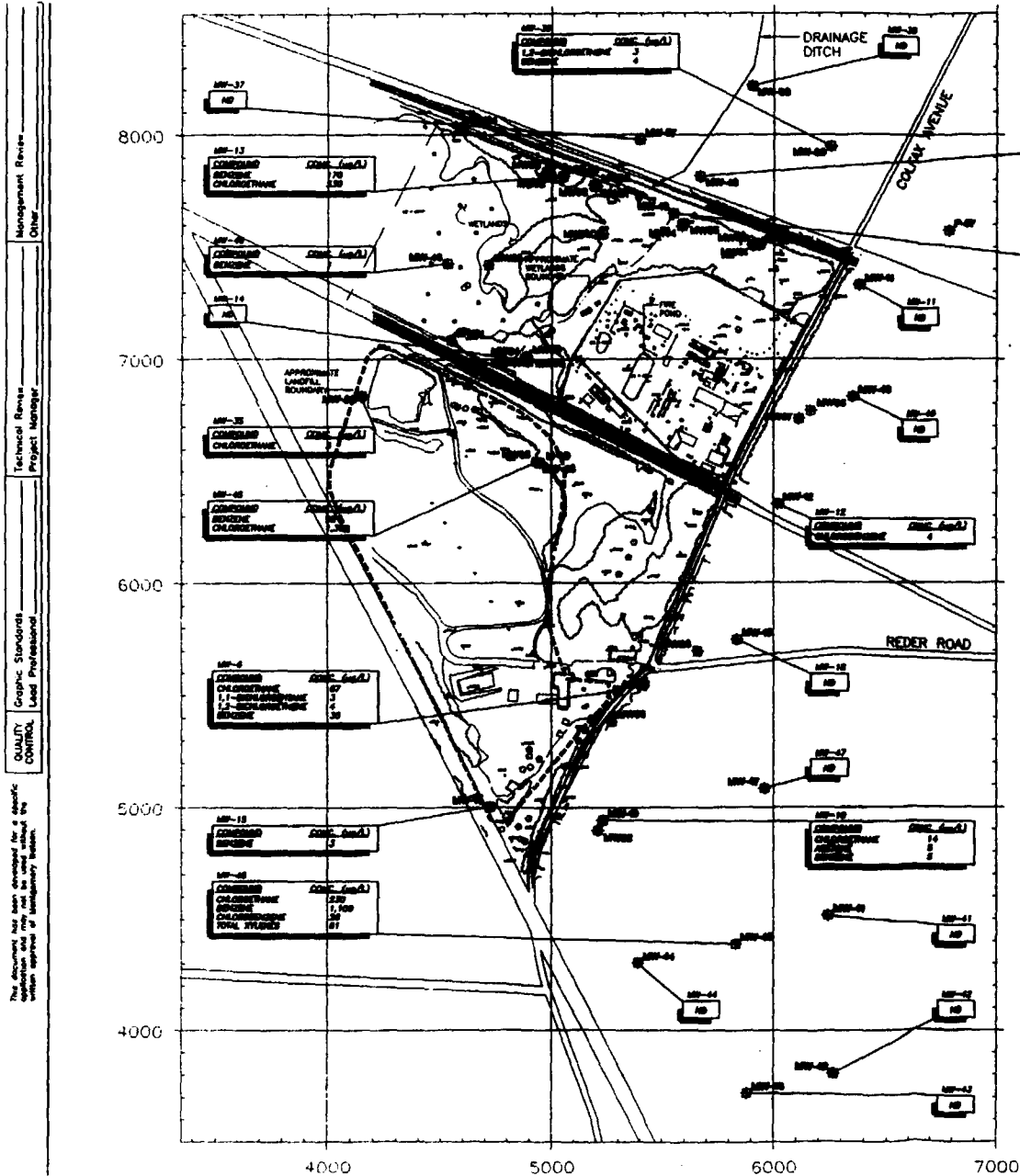
Developed By ACC
 Drawn By DLF/LCL
 Approved By TAB
 Date 5/30/97
 Reference
 Revisions

LOWER AQUIFER POTENTIOMETRIC SURFACE
 MARCH 24, 1997
 1997 BASELINE GROUNDWATER SAMPLING RESULTS REPORT
 AMERICAN CHEMICAL SERVICE, INC.
 NPL SITE
 GRIFFITH, INDIANA

Drawing Number
 1252042
 221602
 B2

MONTGOMERY
 WATSON

FIGURE 2



- LEGEND**
- MP-# UPPER AQUIFER WELL LOCATION AND NUMBER
 - MP-# LOWER AQUIFER MONITORING WELL LOCATION AND NUMBER
 - ug/L MICROGRAMS PER LITER
 - ND NO DETECT
 - (J) INDICATES AN ESTIMATED VALUE

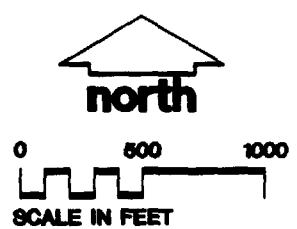


FIGURE 3

VOCs DETECTED IN UPPER AQUIFER MONITORING WELLS 1997 BASELINE GROUNDWATER SAMPLING RESULTS REPORT AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	
Developed By ACC Approved By <i>TAB</i> Date <i>5/30/97</i>	Drawn By DLF/LCL Date <i>5/30/97</i>
Drawing Number 1252042 221602	
BS MONTGOMERY WATSON	

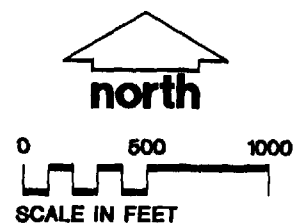
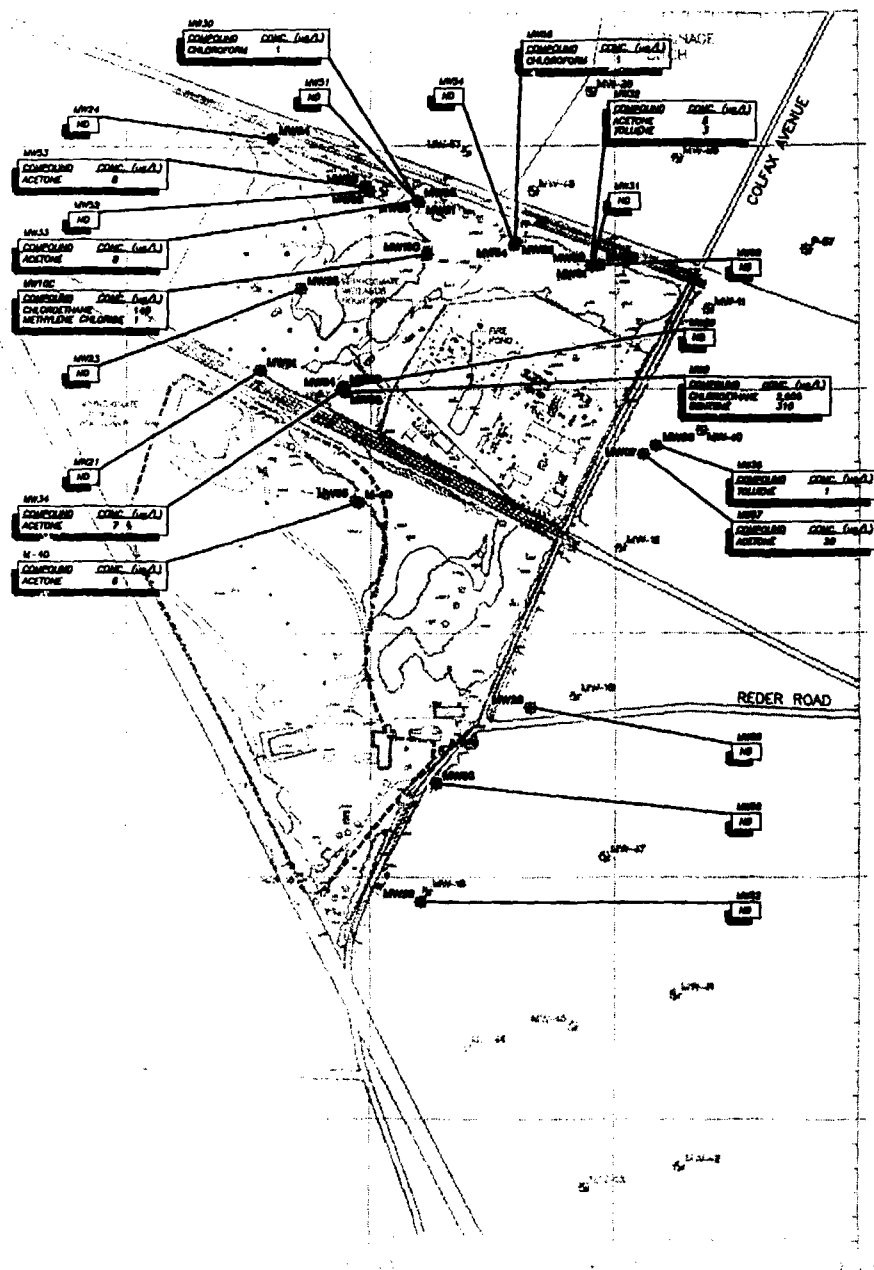
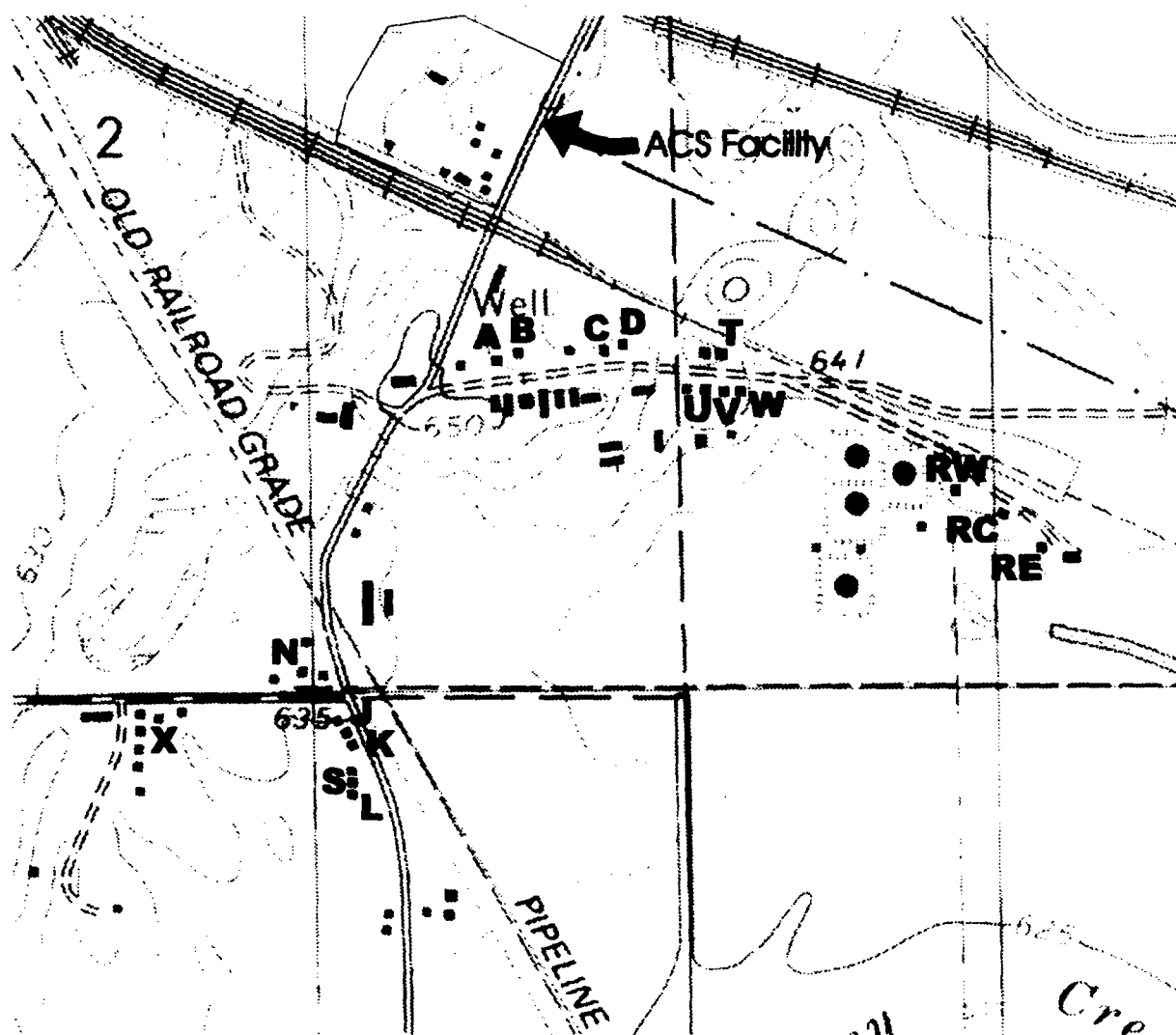


FIGURE 4



MONTGOMERY WATSON

Chicago, Illinois

American Chemical Service, Inc.
Griffith, Indiana

**RESIDENTIAL WELL
SAMPLING LOCATIONS**

FIGURE 5



One copy of the Appendices has been provided to U.S. EPA, IDEM, and B&VWS. Additional copies of the Appendices are available upon request to Montgomery Watson.